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BULLETIN NO. 162

TUBERCULOSIS IN THE UNIVERSITY DAIRY HERD

By CASSIUS C. HAYDEN

URBANA, ILLINOIS, JANUARY, 1913

Summary

1. Tuberculosis is a germ disease and the germ must be carried from one animal to another before the disease can be contracted. Page 379

2. It usually develops very slowly, and an apparently healthy cow may be sufficiently affected to infect the greater part of the herd before discovered. Page 380

3. External symptoms are not common until the disease is well advanced and much damage has been done. The only safe means of detection is the tuberculin test. Page 383

4. A careful test of the University dairy herd revealed over 50 percent of the mature animals diseased. Page 389

5. Subsequent tests revealed few reactors and many of these did not show lesions when slaughtered. Page 391

6. Twenty-three cows in quarantine for an average of two years gave nineteen healthy calves and a total return of $4,436.67. Page 395

7. It is possible for animals that are too badly diseased to react to the test to be in apparent good health and condition and without external symptoms. Page 401

8. On the individual dairyman, aided by the state, lies the task of eradicating the disease. Page 404

TUBERCULOSIS IN THE UNIVERSITY DAIRY HERD

By CASSIUS C. HAYDEN, First Assistant in Dairy Husbandry[1]

INTRODUCTION

A few years ago a large part of the dairy herd of the University of Illinois was found to be tuberculous. Since that time efforts have been put forth to rid it of the disease. The results of these efforts and the treatment of the herd are here given. Believing that the nature of the disease is not generally well understood by farmers, and that their co-operation is absolutely necessary to any successful methods of control, a simple statement of its characteristics is included.

Nature of the Disease

Tuberculosis is strictly a germ disease. It is caused by small, living, growing bodies called bacteria or germs, and it cannot exist unless these germs are present and growing in the tissues of the animal. The germs can grow only in the bodies of living animals, unless cultivated in the laboratory, and no cow can take the disease until in some way the germs have been carried to her from some other animal. While they do not grow or multiply outside the body, they may remain alive for a long period of time if not exposed to sunlight, which kills them in a very short time. They may be in the dirt and mangers of barns long after the animal which dropped them has been removed. This fact makes it easy for another animal to pick them up and contract the disease.

The germs of tuberculosis must be taken into the body before they can cause the disease. They are most frequently taken in thru the nostrils, by breathing in dust, and thru the mouth, with the food. After the germs have got into the body of an animal, they may begin growing wherever they happen to lodge, which is most frequently in the lungs, lymph glands, liver, or lining of the body cavities. They may attack the joints, bones, heart, brain,—in fact, almost any part of the body. It is possible for an animal to take in small numbers and throw them off again or destroy

[1]Now Chief in Dairy Husbandry, Ohio Agricultural Experiment Station, Wooster, Ohio.

them, thus preventing the disease. This power of resistance depends much upon the health and condition of the animal at the time the germs enter the body.

The starting point of the disease is usually a very small one and may remain so for years; or the disease may develop rapidly, destroy the organ in which it is located, break out, and the germs spread thru the body in a very short time, causing "quick consumption." The animal then loses flesh rapidly and soon dies.

FIG. 1. Cow 47.

For example, the cow shown in Fig. 1 produced in thirty days, in the months of February and March, over 2,000 pounds of milk, and died of tuberculosis in July of the same year. In the majority of cases, tuberculosis develops very slowly, and the cow shows no outward signs of the disease until it is well advanced. It may remain at the one small point of infection until the animal dies of old age or some other cause, and it is even possible for the animal to recover entirely. If the breeder wants a clean herd, *it is never safe to keep in the herd an animal which has tuberculosis in any form,* because the disease is liable at any time to become sufficiently advanced to cause the escape of germs from the body. Other animals are then in danger.

When a tubercular abscess breaks into the lungs, digestive canal, genital or urinary organs, or the udder, and the germs escape from the body, a cow has what is called "open tuberculosis." In such cases the germs escape by being coughed from the lungs

into the mouth, where they are thrown out with the saliva and distributed about the manger, watering troughs, salt boxes, etc.; or when coughed from the lungs and swallowed, they escape with the dung. The germs may also be thrown off with the dung when the digestive tract is affected, with the urine when the genital or urinary organs are affected, or with the milk when the udder is affected. Frequently the germs are thrown out in large numbers, and in a short time one tuberculous cow may infect nearly all animals in the herd. This may occur, and the disease become well established, before the owner discovers its presence.

It is impossible to tell just when a cow begins to scatter germs. She may do this for a long period of time and still be sleek and fat. The disease is usually carried from one herd to another by the purchase of a diseased animal or by the use of factory skim milk for feeding calves. It is no respector of breeds, nor is it inherited, tho the calf may be infected by the dam before it is born.

It is commonly believed that the heavy milking cow is most susceptible to tuberculosis, but it should be remembered that even the fattening, or lean, steer, which has no such drain on the system, is by no means immune.

FIG. 2. A PURE-BRED HOLSTEIN-FRIESIAN COW WITH LUNGS AND GLANDS DISEASED.

FIG. 3. A PURE-BRED JERSEY AFFECTED WITH THE DISEASE IN THE LIVER AND LYMPH GLANDS.

FIG. 4. A PURE-BRED GUERNSEY AFFECTED WITH THE DISEASE IN THE LUNGS. SHE WAS UNDOUBTEDLY DISTRIBUTING GERMS.

FIG. 5. COW 39, A PURE-BRED AYRSHIRE, AFFECTED WITH THE DISEASE.

SYMPTOMS OF THE DISEASE

There is a common belief that a cow which has the disease will cough. This may or may not be true, because it depends on whether or not the throat or lungs are affected. There are other diseases which affect these organs and cause cattle to cough; consequently, a cough may or may not indicate tuberculosis. Unfortunately, the disease rarely appears on the outside of the body, and because of this fact it is difficult or impossible to discover its presence by physical examination until it is well advanced, when the animal goes down rapidly in condition and yields to no treatment. Sometimes it appears as an enlargement of the glands of the throat, causing coughing and difficulty in breathing, or as a hard lump in, or enlargement of, parts of the udder. However, other causes may also be responsible for the latter trouble. No farmer should permit a cow which has died or been killed to be buried without an examination of the lungs and the glands between the lungs and on the intestines, unless death was caused by some contagious disease which there is danger of spreading. Frequently such an examination would reveal the presence of the disease in a herd where it was not suspected. The tuberculin test is practically the only means by which it can be discovered during its early stages.

Appearance of Diseased Organs.—The appearance of tuberculous organs is very characteristic, so that the disease is easily recognized after it has once been pointed out in its different forms. It would be a fine thing if every farmer could readily recognize it in slaughtered animals. Hard lumps or cavities in the lungs, containing pus, enlarged glands containing pus or having a "corn meal" appearance, white nodules or abscesses in the liver, knots or bunches on the walls of the lung cavity or intestinal cavity, should be looked upon with much suspicion and considered tuberculous unless they are shown to be otherwise.

FIG. 6. COW 10, SLAUGHTERED A FEW HOURS AFTER PICTURE WAS TAKEN. THE DISEASE WAS SO GENERALIZED THAT THE CARCASS WAS CONDEMNED. A DANGEROUS COW TO HAVE IN THE HERD, ALTHO SHE SHOWED NO EXTERNAL SYMPTOMS.

THE TUBERCULIN TEST

As has been previously stated, tuberculosis cannot be detected easily in its earlier stage by a physical or outward examination; in fact, this is impossible in the majority of cases. If a cow grows thin (pines away), has a persistent cough, or swollen glands of the neck, she should be considered suspicious. However, these symptoms usually appear after the disease is well advanced and the cow has done great damage by infecting other cattle. For this reason these symptoms are of no value except to warn the owner, after it is too late, that his herd is diseased. One reliable method

of detecting tuberculosis when it should be detected is the *tuberculin test.*

In brief, this consists in determining the normal temperature of the animal under normal conditions by taking its temperature at least four (preferably more) times at equal intervals between five o'clock in the morning and eight o'clock in the evening of a given day. About eight o'clock in the evening, a certain amount of tuberculin, varying with the size of the animal, is injected beneath the skin. On the following day the temperature is taken every two or two and one-half hours. If the temperature rises and subsides gradually, giving what is called a typical reaction curve, with the highest temperature two or more degrees above that of the previous day, the cow is considered tuberculous. There are many things which may affect the results of the test, and therefore it should not be applied by persons who have not been properly instructed in its use.

Tuberculin is a liquid which contains the toxin, or poison, produced by the germ of tuberculosis, and it is made in the following manner: Beef broth is made in the laboratory and carefully sterilized, that is, all germs in it are killed by heating it to a high temperature. A small mass of the germs of tuberculosis (*Bacillus tuberculosis*) are taken from other material where they have been grown, placed in this broth, and allowed to grow at body temperature until they have produced a large amount of poison. The broth is then placed in a sterilizer and heated to a temperature high enough to kill all germs, after which it is filtered thru a porcelain filter which removes the dead germs. This filtered broth contains the poison, but neither the living nor the dead germs. After the broth is standardized to a certain strength, a little carbolic acid is added to keep other germs from growing if they should chance to get into it. This liquid, or broth, containing the poison is called tuberculin.

Some persons fear that the use of tuberculin will give cattle tuberculosis. It cannot because the germs have been killed and then removed. It is possible that, in case the animal injected is diseased, it may cause the disease to become more active, but this has not been definitely proved. If a cow is healthy, tuberculin has no effect when injected, nor afterwards, so far as the best authorities have been able to determine. It does not affect the milk of a healthy cow; in many cases the milk from herds under test has been supplied to children and adults as usual, and in no case has it been definitely shown to cause any trouble. If a cow reacts, the fever produced may affect the quality of the milk and it would be best to exclude the milk of such animals during and after the reaction.

Accuracy of the Test.—If properly applied, this test is ex-

tremely, tho not absolutely, accurate. That is to say, if a cow reacts, she is practically certain to have the disease in some stage. The Bureau of Animal Industry of the Department of Agriculture at Washington, D. C., has found that out of 24,784 cattle which reacted to the test, ninety-eight out of every hundred showed the disease when slaughtered. The work here reported does not show as high a percentage of accuracy. This may be understood when the reader recalls that a small spot the size of a pea may cause a reaction, and that the test does not tell the extent of the disease in the animal. So small a spot might easily be overlooked in slaughter. Ninety-eight percent is a greater percentage of accuracy than can be shown by almost any other method of detecting disease.

Faults of the Test.—(1) The tuberculin test does not always pick out the worst cases, because the system of such an animal is already so full of the poison that the addition of a little has no marked effect. Such cases can usually, but not always, be detected by a physical examination. These are the most difficult cases to deal with. Note the cases of Cows 34 and 85, page 400.

(2) Another time that the test may fail is when the disease is in the "incubating" stage, that is to say, when the germs have got into the body but have not yet begun to grow. These cases can be easily detected by later tests.

(3) The third case is when the disease is a small spot and has become encysted, that is, has ceased to grow and has become incased or surrounded by a tough, thick membrane which prevents the escape of the germs to other parts of the body. If these places break out, they can be detected by later tests.

(4) Tuberculin may be misused by unscrupulous persons. For some time after a large dose has been given, some cows possess an immunity, or power to resist the test, so that if a second dose is given in a few days, or possibly three months, they fail to react again. This resistance passes off in from a few days to three months. Sometimes this "plugging" is done just before a herd is to be tested for sale or shipment to another state. Such wilful misuse of the test has acted to spread the disease by sending diseased animals into healthy herds.

(5) It is possible that a cow's temperature might rise from some other cause. The loss of a cow in this way should be considered the price of insurance against the disease.

The test is of little or no value if the information it gives is not properly used. *Every animal which reacts should be removed from the herd and branded, so that she cannot be ignorantly taken into another herd.* A good cow may look sleek, fat, and healthy, and it is a temptation to keep her in the herd, but she may be the very one which is spreading the disease (see Cow 85, page 401).

FIG. 7. COW 49, SLAUGHTERED AT DEMONSTRATION AT MIDSUMMER INSTITUTE AND FOUND TO BE BADLY DISEASED. SHE REACTED TWICE, TWO YEARS APART.

Because some cows have the disease in the incubating stage and others in the encysted form, the test should be repeated each six months until no more cases are found, and once each year thereafter. It is always safe to isolate purchased animals and retest them after three months. After the reacting cattle are removed from the herd, the barn should be thoroly cleaned and disinfected or the disease is nearly certain to spread again, due to the fact that the germs dropped by the animals removed may remain alive for a long period of time. The disinfecting should be carefully and thoroly done.[1]

VACCINATION

Attempts have been made to protect cattle from tuberculosis by the use of "vaccine," but this method has not proved successful and is even dangerous. Vaccination consists in inoculating the animal with tubercle bacilli of low virulence, or activity. It is supposed that the animal will develop an immunity, or power of resistance, because of these weak germs, but with the present method of vaccination *there is real danger of causing the disease.*

[1]See U. S. Farmers' Bulletin No. 480, "Practical Methods of Disinfecting Stables."

METHODS OF HANDLING DISEASED ANIMALS

When tuberculosis is discovered in the herd, rigid measures should be taken to eradicate it, for the longer it remains the more firmly it will become established and the more difficult it will be to get rid of. Where only a few animals react, they may be removed and the remainder of the herd tested every six months until no more cases are found. If one-half or more of the animals are tuberculous, the chances are that many other members of the herd have the disease in the incubating or encysted stage and will react later; therefore it usually is better to treat the entire herd of mature animals as if they were diseased. One of two methods may be adopted: If the animals are not very valuable for breeding purposes, it probably will be best to dispose of the entire herd by slaughtering them under proper inspection, and replace them with young or tested animals. Even in buying subject to the test, one runs the chance of getting diseased animals for the reasons mentioned above, tho this danger is much less with young animals.

If it is a herd of pure-bred cows or cows valuable for breeding purposes, it may be handled by the "Bang method." With this method the cows are placed in quarantine, and the calves are removed as soon as born and fed milk from healthy cows or the milk of their dams first heated to a high enough temperature to kill all germs. Not over one or two percent of such calves are diseased, and a healthy herd of young stock can soon be built up from tuberculous dams. The milk from such a herd, if properly pasteurized, may be used for making butter. No milk should be used from a cow showing any signs of the disease in her udder, and no animal showing outward signs of tuberculosis should be permitted to live even in the diseased herd.

When the "Bang method" is practiced, it is necessary to keep the infected cattle entirely separated from the rest of the herd. It is better if they can be kept in different barns or on different farms. They should not be cared for by the same person wearing the same clothes, especially shoes, because the germs may be carried from the infected herd to the feeding floor of the other herd in manure which may cling to the attendant's shoes.

If the owner is willing to put forth a *very strenuous* effort and use strictly sanitary measures, he can entirely eradicate the disease from his herd. The man who is ignorant or careless will usually fail in the attempt. That it can be done has been shown by different experiment stations and by many individuals in this country. The task is not an easy one, but requires constant attention from the time the first case is discovered until no more are revealed by the test.

FIG. 8. COW 66, SHIPPED TO CHICAGO AND SLAUGHTERED UNDER FEDERAL AND STATE INSPECTION. THE DISEASE WAS SO GENERALIZED THAT THE CARCASS WAS CONDEMNED.

If the disease is not eradicated, it takes its toll more or less regularly. Besides the occasional complete loss of an animal, it reduces the productive power of others, causes sterility, and may cause additional loss by infecting hogs which run after the cattle or consume the milk.

TUBERCULOSIS IN THE UNIVERSITY DAIRY HERD

In the spring of 1906 a grade cow, purchased for experimental purposes, died, and a post-mortem examination revealed a few tubercular centers in the lungs. This was sufficient evidence that the disease was in the herd, and it was thought best to test at least the cows which were producing milk for city trade. Thirty-four of the mature cows were subjected to the tuberculin test, thirteen of which reacted. About ten others were not tested, because they were near to calving, or for other reasons. One or two of the reactions were considered questionable. Five of the thirteen which reacted were slaughtered and examined. The disease was found in each of the five reactors, but in no case had it become generalized. The others appeared to be in such good health that they were kept in the herd. Later they were slaught-

ered, and in nearly every case were apparently not far enough advanced to be throwing off the germs. One cow (No. 34), which was undoubtedly badly diseased, or became so soon after, passed thru this first test and probably caused much of the infection revealed by the test made in May, 1908.

The remaining cows and a part of those previously reacting were tested in December of the same year. Of the fifteen tested, ten reacted, five of which had previously reacted. Seven of the reactors were slaughtered at this time.

FIG. 9. COW 51, DISEASE GENERALIZED AND CARCASS CONDEMNED UNDER FEDERAL INSPECTION.

In June, 1907, the herd consisted of fifty-five females, including calves. Five which were suspicious or had reacted were tested at this time. Two of these reacted.

The next test was made in May, 1908. In the meantime the writer had taken full charge of the herd. There were then sixty-seven females in the entire breeding herd. Fifty of these, or practically all that were considered old enough, were tested. Of the fifty tested, twenty-six, or 52 percent, reacted and were removed from the herd. Among the reactors were some of the best cows in the herd. These, with a few others, were placed in quarantine to secure their progeny and for experimental purposes. The others were slaughtered.

The next test was made in the fall of 1908. There were at that time fifty-six females in the herd, including seven purchased. Thirty-six which were old enough were tested, and three which reacted were removed from the herd.

The next test was made one year later, in the fall of 1909, when there were seventy-eight females in the herd. Sixty-seven were tested, and four reacted. In the spring of 1910 there were seventy-two females; fifty-seven were tested, and one reacted. In the fall of 1910 there were seventy-seven females; seventy-two were tested, and none reacted. The following spring (1911) there were eighty-eight females; of seventy tested one reacted but showed no evidence of tuberculosis when slaughtered, altho a careful examination was made. In the fall of 1911 there were ninety-six females, ninety of which were tested, resulting in one reaction. The last test was made in March, 1912, at which time there were ninety-five females in the herd; eighty-one were tested, and four reacted. Despite the great loss, and with the addition of a few calves from the experimental herd, the number of females increased from fifty-five in 1907 to ninety-one clean females in March 1912 (See Figs. 16 and 17). During this time, nineteen females were added to the herd by purchase and thirty-two non-reactors were sold.

The following chart shows the number of females in the herd, the tests made, and the reactions and non-reactions. Each heavy line represents an individual, and the length of the line indicates the time during which she was in the herd. "T" indicates that a test was made. A minus (−) sign after the "T" indicates a negative result, or a non-reaction, and a plus (+) sign, a reaction. "P" indicates that the animal was purchased; all others were originally in the herd or were born either in the breeding or in the experimental herd.

A study of the chart will show that the seed was well sown during the "seeding time" previous to 1908, and that the harvest was reaped in May of that year when 32.6 percent reacted. Of the forty-seven mature cows in 1906, only three remained in the herd after 1909, and only five went out for other causes than tuberculosis. This shows that once a herd of mature animals becomes badly diseased, it is probably best to consider the entire herd affected and treat it accordingly.

In the breeding herd 170 different females have been tested, and fifty, or about 30 percent, reacted.

FIG. 10. RESULTS OF TUBERCULIN TESTS ON FEMALES IN HERD.

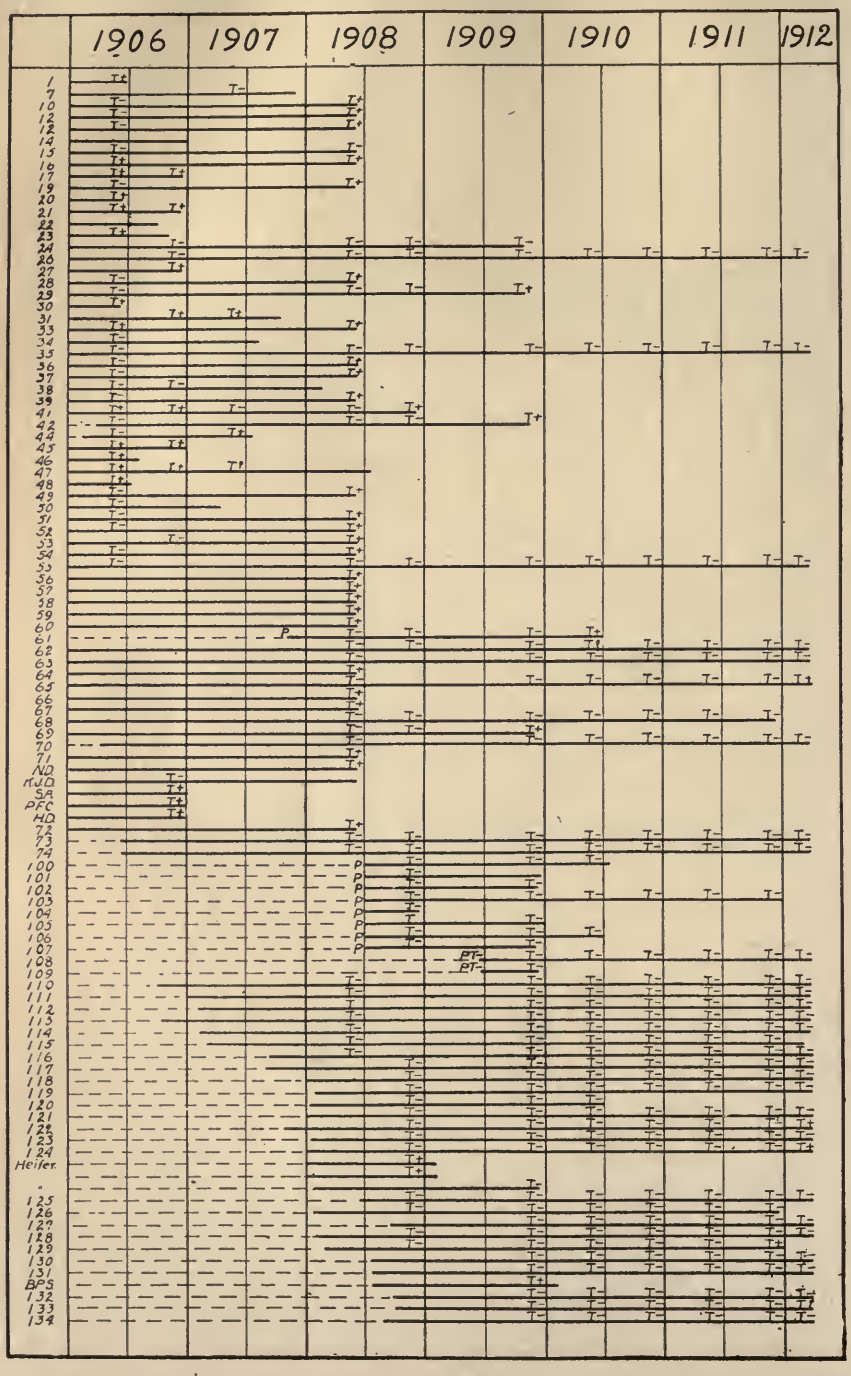
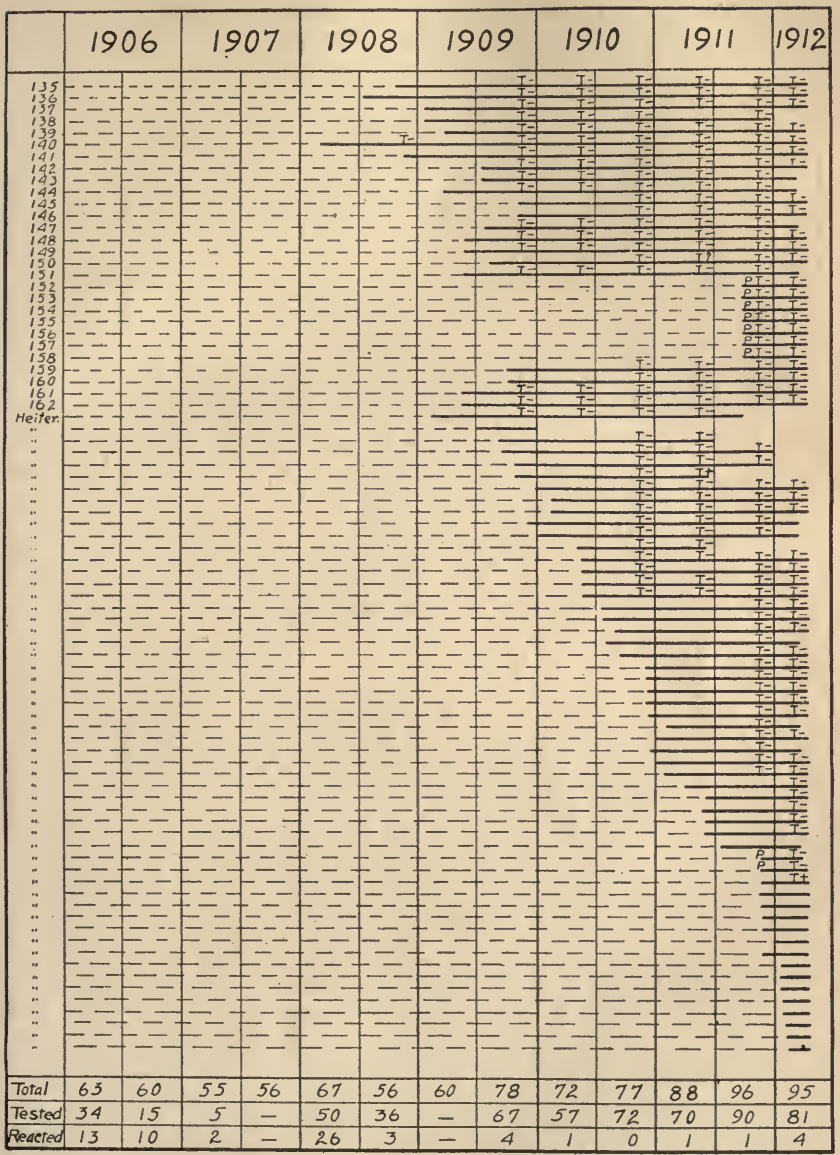


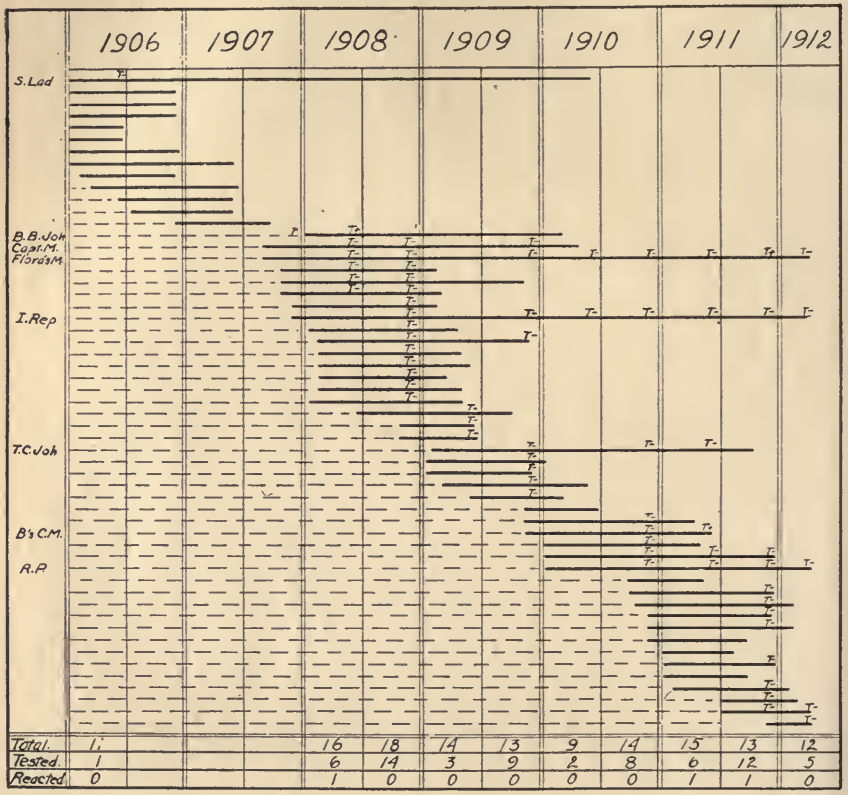
FIG. 10. *Continued.*



	1906		1907		1908		1909		1910		1911		1912
Total	63	60	55	56	67	56	60	78	72	77	88	96	95
Tested	34	15	5	—	50	36	—	67	57	72	70	90	81
Reacted	13	10	2	—	26	3	—	4	1	0	1	1	4

Bulls.—Between May, 1906, and December, 1911, five mature bulls and thirty-two young ones, ranging in age from six months to two years, were tested, and three reacted. Fig. 11 shows the results of the tests made on the bulls.

FIG. 11. RESULTS OF TUBERCULIN TESTS ON BULLS IN HERD.



It will be noted that only one young bull reacted. With other calves, he was fed on milk from the quarantined herd. This milk was supposed to have been sterilized before feeding, but this may not always have been perfectly done.

Lad, the herd bull, was kept with the quarantined herd and not tested after 1906. A younger herd bull reacted in May, 1908, and was also kept with the quarantined herd.

Twenty-six bull calves less than six months old and from clean cows were sold without test and are not shown on the chart. Some of those shown were tested individually as sold, but the tests were not recorded and hence are not shown on the chart.

QUARANTINED COWS

Fig. 12 shows the results obtained from nineteen of the pure-bred reacting cows which were quarantined in 1908, and four others which were quarantined later. It shows the herd number of the animal, its approximate value before becoming tuberculous, the time in quarantine, the tests made, the findings on post-mortem, and the receipts for or the value of the carcass, milk, and progeny. Cows 36, 49, and 56, were slaughtered at a demonstration at a summer institute in August, 1910; hence no value is given for those carcasses.

FIG. 12. RESULTS OBTAINED FROM PURE-BRED REACTING COWS.

Value before Tuberculosis	1908 Herd No.	1909	1910	Post Mortem	Received for Carcass	Received for Milk	Value of Progeny	Total
$ 100	10	T+	T+	+con	$ 6 75	$ 84 71	$	$ 91 46
200	16	T+	T+	+	43 67	163 71	100	307 38
100	33	T+	T+	−	67 10	107 96	75	250.06
150	36	T+	T+	+	—	137 13	200	337.13
100	39	T+	T+	+	27 77	113 44	80	221 21
200.	49	T+	T+	+	—	98 77	100.	198 77
100	51	T+	T+	+con	7 58	127.88	85	220.46
75	52	T+	T+	+con	5.00	98.25	—	103.25
100	54	T+	T+	+	25 50	62 74	—	88.24
150	56	T+	T+	+	—	78.61	5	83.61
75	57	T+	T+	+con	6.75	76.41	—	83.16
100	58	T+	T+	+con	7.00	77 87	75	159.87
100	59	T+	T+	+	57.91	111 38	70	239.29
125	60	T+	T+	+	44 59	127.14	90	261.73
150	64	T+	T+	+	30 40	130.08	180	340.48
150	66	T+	T+	+con	7 96	111 15	100	219.11
150	67	T+	T+	?	33 12	115 74	150	298.86
150	71	T+	T+	+	34 43	139.63	180	354.06
150	72	T+	T+	+	43 67	25 91	80	149.58
175	41	T+	?	+	43 61	128 99	100	272.60
175	29	T+	T−	?	25.50	57 05	—	82.55
175	42	T+	T−	+	12 50	23 75	—	36.25
100	Heifer			−	37 56	—	—	37 56
$ 3050				$	568 37	$ 2198 30	$ 1670	$ 4436.67

The quarantined herd was kept in existence for about two years at a cost of sixty dollars per head per year, or a total cost of about $2700 for the two years.[1] The gross returns during that time were approximately $4436, making a net return of $1736. It is probable, however, that the cost under these conditions was greater than it would be in an ordinary herd.

[1] Cost estimated from Circular 134 of Ill. Agr. Exp. Sta.

FIG. 13. COW 56, SLAUGHTERED AT SUMMER INSTITUTE. LUNGS, LIVER, AND LYMPH GLANDS AFFECTED.

The reacting cows were placed in a separate wing of the barn, and the passageway to the main barn was closed. Attendants were not permitted to go from one barn to the other without changing clothing, especially shoes. One man, with such help as he needed to properly care for them, was given charge of the tubercular cows. A small yard, separated from the other yards by a high board fence, in which the cows could exercise, was provided. The feed was brought to the door from the main barn by those caring for the clean herd, but they were not permitted to go inside.

When a calf was born in the quarantined herd, it was immediately removed and later placed in the clean herd. Of twenty-five calves so removed but one reacted to the test later, and she reacted when about two years of age. At the same time and in the same barn, a bull from a clean cow reacted. Probably both became infected from the same source. When the heifer was slaughtered, no signs of tuberculosis were found.

This shows the possibility of securing clean calves from infected dams. Cows 52 and 54 were not registered animals, and no progeny were saved from them. Three or four calves were lost by abortion, or died shortly after birth. There were no evi-

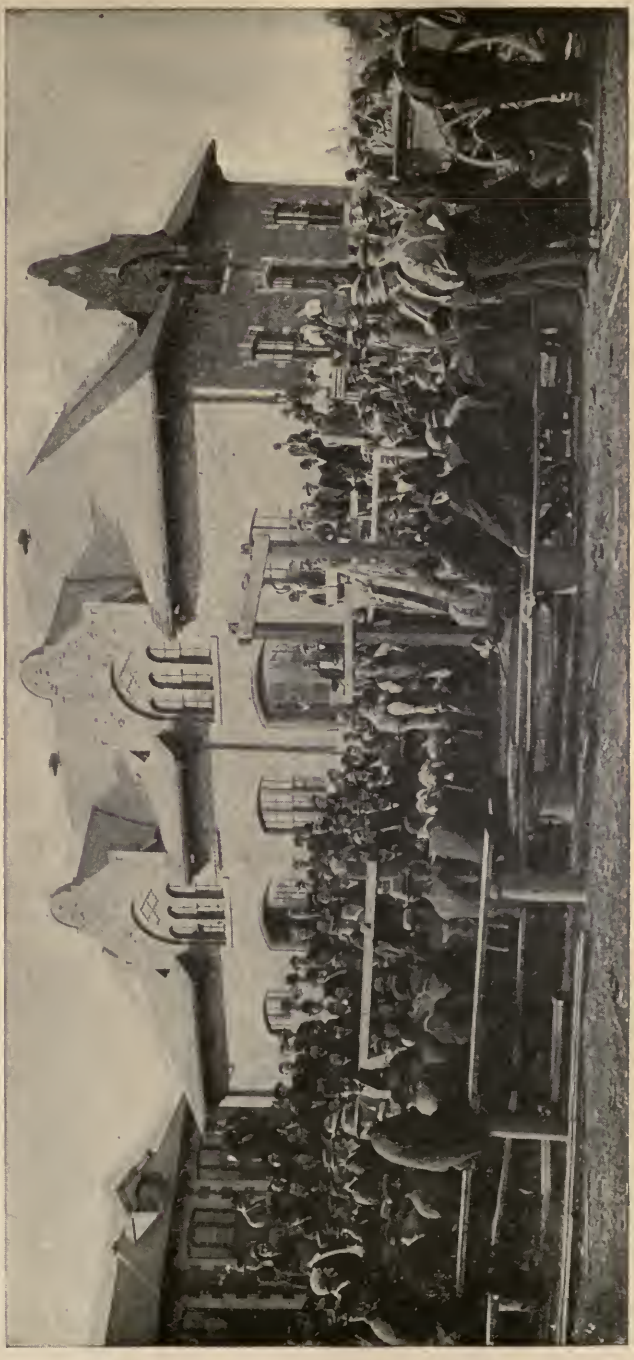


FIG. 14. A DEMONSTRATION AT THE UNIVERSITY OF ILLINOIS IN WHICH THREE REACTING COWS WERE SLAUGHTERED, ALL OF WHICH SHOWED THE DISEASE.

dences of tuberculosis in these cases. The value of the progeny shown in the chart is based on the prices for which calves were actually sold.

After all the reacting cows were removed from the herd, the barn was thoroly cleaned, the floor scrubbed and allowed to dry, after which the entire interior was thoroly disinfected with a solution of corrosive sublimate (one-half pound to thirty gallons of water).

EXPERIMENTAL HERD

Between June, 1906, and 1910, forty-one cows were purchased for experimental purposes without being previously tested. Twenty-two of these, or over 50 percent, reacted. In one group of fourteen cows selected from seven herds in the northern part of Illinois, all but one proved to be tuberculous. All the forty-one except eight came from the northern part of the state and most of them originally from Wisconsin. This gives some idea of the extent of the disease in the dairy section and the means by which it is spreading. These cows were all in apparently good condition, and no one would have suspected that they were diseased. One of the cows which did not react was finally thrown out because of failure to breed and because of a suspicious cough. She proved to be infected with tuberculosis in the advanced stage.

Seventy-five animals have been lost from both herds because of the disease.

RESULTS OF SLAUGHTER

From May, 1906, to March 31, 1912, seventy-six animals reacted; seventy-five of these, together with fifteen which did not react, were slaughtered. A part of these animals were slaughtered on the farm, a part at the local packing house, and the remainder in Chicago under federal and state inspection. The results are shown in Table 1.

Of the seventy-six reacting animals sixty showed the disease, four were doubtful, and eleven showed no lesions. Of the four which were doubtful, Cow 13 and Cow 21 had diseased udders and Cow 23 was afflicted with chronic scours. Cows 21, 23, and 17 were not carefully examined. Cows 13, 33, 61, 67, 69, 79, one heifer, and one bull were slaughtered at Chicago, where the inspection is necessarily hastily done. Cows 122 and 124, which reacted at the last test, showed no lesions except an abscess on the rumen of each, due to a wire and a nail. These were in the herd previous to the May, 1908, test; and it is possible that they, with others, may have carried the germs inactive in their bodies during previous tests. This is a large percentage of re-

TABLE 1.—RESULTS OF SLAUGHTER

Herd No.	Test	Post-mortem	Herd No.	Test	Post-mortem	Herd No.	Test	Post-mortem
1	+	×	71	++	×	Lad	−?	×
10	++	×	72	++	×	90	No test	×
12	+	×	76	+	×	85	−−	×C
16	++	×	77	+	×	34	−	×C
19	+	×	80	+	×	13	+	?
20	+	×	83	+	×C	21	+	?
27	+	×	84	+	×	29	+?	?
28	+	×	86	+	×	23	+	?
30	+	×	87	+	×	17	+	0
31	++	×	88	+	×	33	?++	0
36	++	×	92	+	×	61	?+	0
37	++	×	95	+	×	67	++	0
39	++	×	97	+	×	69	+−	0
41	++	×	129	+	×	79	+	0
42	+−	×	1002	+	×	Heifer	+−	0
44	+	×	1004	+	×	"	+	0
45	++	×	1005	++	×	Toe	+	0
46	+	×	1007	+	×	65	+	Not sl't'd.
47	++?	×	1008	+	×	14	No test	0
49	++	×	1017	+	×	68	−−−	0
51	+++	×C	Bull	+	×	104	−	0
52	+	×C	Grade	+	×	106	−	0
53	+	×	Heifer	+	×	109	−	0
54	++	×	"	+	×	Heifer	−	0
56	++	×	Grade	+	×	1027	−	0
57	++	×C	Heifer	+	×	120	−	0
58	+++	×C	"	+	×	100	−	0
59	++	×	"	+	×	106	−	0
60	++	×	"	+	×	122	+	0
64	++	×	15	−?	×	124	+	0
66	++	×C						

+=a reaction; − =test without reaction; × =disease found; ? = questionable; 0=nothing found; C =carcass condemned.

actors not showing the disease, but when it is considered that a very small center will cause a reaction, and that such a center may be located in almost any part of the body, one can understand how evidence of the disease could be readily missed in a hasty and incomplete examination. It is possible that the high temperature in some of these cases was due to other causes.

The fifteen which did not react were divided as follows: Cow 15 and "Lad" failed to react, but were subsequently placed with the diseased animals for nine months and two years respectively, and were not retested. This gave them ample time to become diseased. Cow 90 had not been tested but was dying with the disease when killed. Cow 14 was not tested, and the remaining nine did not react, tho some of them were thrown out on suspicion.

TABLE 2.—REACTIONS OF ANIMALS WHICH DID NOT SHOW DISEASE WHEN SLAUGHTERED

Herd No.	Temperature before injection	Temperature after injection
17	101.2, 100.6, 102.3, 102.0	101.4, 103.9, 103.9, 104.2, 103.8, 104.0
33	(1) 101.4, 101.4, 101.3, 102.0, 101.0	(1) 101.4, 101.5, 101.9, 105.0, 105.8, 105.6
	(2) 101.2, 101.5, 101.1, 101.8, 101.2, 100.8	(2) 100.8, 101.2, 104.8, 104.6, 104.9
61	101.0, 101.5, 101.4, 101.4, 101.0 101.8	101.7, 105.3, 104.7, 104.2, 103.7, 103.6
67	(1) 100.8, 101.2, 101.5, 101.8, 102.2	(1) 101.7, 104.6, 105.9, 105.3, 104.0, 102.7
	(2) 101.2, 100.8, 101.2, 102.0, 101.2, 100.9	(2) 102.6, 104.8, 106.8, 105.3, 105.2
69	(1) 102.5, 102.0, 101.8, 102.2, 102.4, 102.8	(1) 102.2, 104.0, 105.5, 105.0, 104.7, 104.0, 103.4
	(2) 101.0, 101.6, 102.3, 102.3, 102.3, 103.2	(2) 102.0, 101.6, 102.4, 102.1, 102.5
Heifer	(1) 101.8, 102.8, 101.0, 101.6, 101.6, 101.6, 101.4	(1) 102.8, 104.4, 104.6, 104.4, 103.0
	(2) 100.9, 101.9, 101.6, 101.7, 101.6, 101.6	(2) 101.6, 102.7, 101.4, 102.2, 102.6
Heifer	101.6, 101.2, 101.2, 100.2, 102.4 101.8	103.4, 105.0, 105.3, 105.0, 104.6, 105.0
122	101.6, 101.4, 100.8, 101.5, 101.6	103.4, 104.8, 104.0, 103.1, 102.5, 101.6, 101.4
124	102.1, 101.8, 101.2, 102.5, 101.6	102.8, 101.8, 102.0, 102.4, 102.8, 100.8, 99.8, 103.0, 104.4, 104.8, 103.6, 102.8, 102.8

The temperature of Cow 17 increased less than two degrees. Neither reaction was typical in the case of Cow 33, the temperature rising suddenly and remaining practically constant. Cow 69 and one heifer failed to react at second test, and showed no signs of the disease when slaughtered under federal and state inspection. The other two, Cows 34 and 85, deserve special consideration.

Cow 34 failed to react when tested in May, 1906. At that time she was not milking and failed to breed; hence, she was in excellent condition. About a year later she began to go down in flesh and would have died in July had she not been killed. When examined she proved to be the worst case the writer has ever seen; the abdominal cavity was one mass of tubercles, and other parts of the body were badly diseased. It is probable that she was too far advanced and her system was already too full of the poison at the time tested to react. However, it was entirely

possible for her to have become infected after the test. The writer believes that this cow was responsible for spreading much of the infection revealed by the test made in May, 1908. A large percentage of the two-year-old heifers which were with her in pasture reacted.

FIG. 15. Cow 85.

Cow 85 passed thru three tests without reacting. She was a small cow purchased in northern Illinois, and was a heavy feeder and milker. Up to the time slaughtered, she was in very good flesh and physical condition. The only thing which would indicate the disease was a cough. She failed to breed readily and was sold for beef subject to inspection. She was found to be very badly diseased. In general, cows in which the disease is too far advanced for reaction show external symptoms, but the writer does not believe that even an experienced veterinarian would have detected the disease in either Cow 34 or 85 by a physical examination. These two cases emphasize the fact that mature animals in a herd which is *badly* infected should be looked upon with much suspicion even tho they do not react.

Cow 68 passed several tests successfully but had a cough for two or three years. Since she was one of the animals in the badly infected herd, it was thought that possibly she also might have the

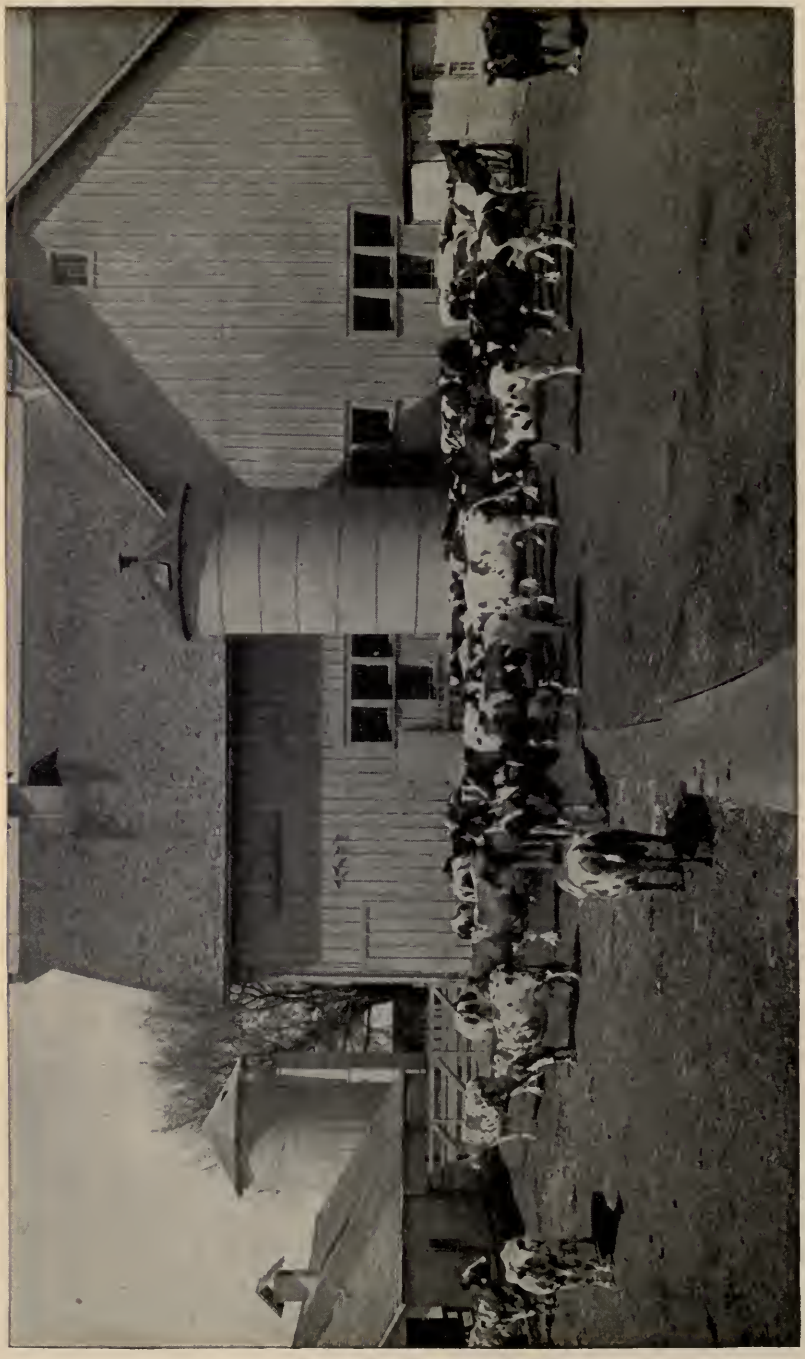


FIG. 16. THE NON-REACTING COWS IN THE HERD MAY, 1911.

FIG. 17. THE NON-REACTING YOUNG CATTLE IN THE HERD MAY, 1911.

disease in the advanced stage. She was not in as good condition or flesh as was Cow 85. She was slaughtered but proved to be free from the disease, the cough being due to some other cause.

STATE AID

Tuberculosis is probably on the increase among the dairy cattle of Illinois and the only means we have of checking or reducing it is by means of the tuberculin test and better sanitary conditions. While the test is not infallible, it is the only method we have of detecting the disease before the affected cow becomes dangerous. Because it sometimes fails, it is no more wise to refuse to use it than it would be to refuse to use antitoxin for diphtheria because it sometimes fails to cure.

The states surrounding Illinois have passed laws to prevent the introduction of tuberculous animals, and other measures are being enacted to assist the dairymen in cleaning up their herds. Illinois has no such laws; consequently this state has become a dumping ground for diseased animals from other states. It is time that the farmers of Illinois see to it that wise legislation is enacted. Tuberculosis and contagious abortion are probably the two greatest problems which dairymen must meet in the future, and they must have aid in dealing with them. The following bill, which was introduced into the State Legislature in 1909, is printed here because the writer believes that it contains the desirable features of a wise bill.

A BILL

FOR AN ACT TO PROTECT THE HEALTH OF DOMESTIC ANIMALS IN THE STATE OF, ILLINOIS, AND MAKING AN APPROPRIATION THEREFOR.

SECTION 1. *Be it enacted by the People of the State of Illinois represented in the General Assembly:* That the importation or bringing into the State of Illinois of any cattle for dairy or breeding purposes is hereby prohibited, excepting when such cattle are accompanied by a certificate from an inspector, whose competency and reliability are duly certified to by the authorities charged with the control of the diseases of domestic animals in the State, territory, district, province or country from whence such cattle came, certifying that they have been examined and subjected to the tuberculin test and are free from tuberculosis. Such certificate shall be in such form as may be prescribed by the Board of Live Stock Commissioners of Illinois, and shall include the tuberculin test record of the animals, and shall be made in triplicate, one of which shall be forwarded by mail to the Board of Live Stock Commissioners of Illinois, one to go to the railroad or transportation company to be attached to the bill of lading for such animals, and one to be given to the purchaser. The Board of Live Stock Commissioners of Illinois shall adopt such rules as they may deem necessary for conducting such tuberculin test for the purpose of insuring reliable results therefrom.

Sec. 2. No shipment of cattle for dairy or breeding purposes from any point outside of this State destined to any point within this State, shall be re-

ceived or brought within this State by any railroad, steamboat or transportation company, or by any express company, or by any electric line, doing business in this State, from any person, firm or corporation, or from any connecting railroad or transportation company, nor shall any such cattle be brought within this State from any point outside of this State by any person, firm or corporation, on the hoof or otherwise, unless the same be accompanied by the certificate provided for in section 1 of this Act, and unless the regulations restricting such shipments have been fully complied with by the consignor; and no person, company or corporation shall purchase or receive such animals unless the same be accompanied by such certificate.

Sec. 3. Any dairy or breeding cattle imported or brought into the State of Illinois in violation of the provisions of sections 1 or 2 of this Act, or in violation of any regulation adopted by the Board of Live Stock Commissioners as herein provided for, shall be placed in quarantine by said Board of Live Stock Commissioners, and held until tested with tuberculin by and under the direction of said board, at the expense of the owner, shipper or consignee; and all expense connected with such quarantine shall be paid by the owner, shipper or consignee, and together with the costs of conducting the tuberculin test, shall constitute lien on such cattle. Any such cattle that may react to the tuberculin test shall be slaughtered and examined post mortem under State supervision as provided by law; and no indemnity shall be allowed the owner, shipper or consignee, beyond the net proceeds realized from the sale of the carcass of such reacting animal.

Sec. 4. The Board of Live Stock Commissioners is hereby authorized and empowered to prohibit or restrict the importation of any domestic animals into the State of Illinois, whenever in their judgment such measures may be necessary for the proper protection of the health of the domestic animals of this State.

Sec. 5. Said board shall have power in like manner to regulate and prohibit the running of any cars or boats into this State or within the State, that have been used for the transportation of animals affected with any contagious or infectious disease, or the condition of which may be such as to render them liable to convey the infection, and to compel the proper disinfection of the same. Said board shall also have power to regulate and prohibit the importation into this State or the carrying within this State of hay, straw, fodder or other commodities, and to regulate and prohibit the importation or carrying of the carcasses, or any part of the carcasses, of any animals—including the hides, hoofs, bones and hair—through which any live stock in this State may become infected.

Sec. 6. It shall be unlawful to offer for sale, or to purchase, any cattle for dairy or breeding purposes, known to have reacted to the tuberculin test, or to be affected with tuberculosis, except for purposes of slaughter at a point where adequate inspection exists, or for breeding purposes to go in quarantine under the direction of the State Board of Live Stock Commissioners.

Sec. 7. The Board of Live Stock Commissioners shall prescribe uniform rules for the tuberculin testing of live stock, and *upon request of the owner thereof* shall cause such test to be made, at the expense of the State. All such cattle so tested which shall react to the tuberculin test shall become at once subject to the charge and control of said Board of Live Stock Commissioners. Thereupon such reacting animals shall be appraised as provided by law, and shall be disposed of by said board in one of the following ways, at the option of the owner to be exercised at that time:

First—the owner may elect to have such animals separated from non-reacting animals in accordance with what is known as the "Bang System," and retained upon the farm or premises under such quarantine regulations as the board may prescribe; or

Second—he may take as compensation for such animals a sum equal to three-fourths of the appraised value thereof; or

Third—he may agree to receive as compensation for such animals the net proceeds of the slaughter and sale thereof.

Any slaughter and sale of such animals shall be done and had by the board in the manner provided by law. In any case of appraisement as provided herein, where upon post mortem examination there is found to be no tubercular lesion, then the animal shall be regarded as healthy, and the owner shall receive the full appraised value thereof. If upon application of the test for tuberculosis, there is found to exist open tuberculosis, the said board shall make such further tests of such cattle as it may find necessary or expedient to repress the disease or prevent infection.

Sec. 8. After any test of a herd has been made by the board and the disease of tuberculosis is found, the said Board of Live Stock Commissioners shall have such supervision over such herd and the premises where they are kept, and may prescribe such rules and regulations in reference thereto, as may be necessary to prevent reinfection of such herd or the spread of disease among them.

Sec. 9. It shall be unlawful for any corporation, company or person operating any creamery or cheese factory, with milk or cream gathered from miscellaneous sources, to return to the patrons or offer for sale either skim milk, buttermilk, or whey, until the same is properly pasteurized by heating to eighty degrees Centigrade (176 degrees Fahrenheit), as determined by Storch's color test: *Provided,* that the Board of Live Stock Commissioners shall have power to release any such creamery or factory from the limitations of this provision when to their knowledge tuberculosis does not exist in the herds contributing to their supply.

Sec. 10. The Board of Live Stock Commissioners is hereby charged with the enforcement of the provisions of this Act, and is authorized and empowered to prescribe such rules and regulations as may be necessary for such purposes.

Sec. 11. For the purposes of this Act the Board of Live Stock Commissioners shall have power and authority to control and restrict the sale and use of tuberculin.

Sec. 12. Any person who shall use or cause to be used by any other person, tuberculin or any other agent upon cattle, by injection or otherwise, for the purpose of preventing a proper reaction when the tuberculin test is made by an intending purchaser or other person, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than two hundred dollars nor more than five hundred dollars, or by imprisonment in the county jail not more than one year nor less than six months, or by both such fine and imprisonment.

Sec. 13. Any railroad, steamboat or transportation company, or any express company or electric line, that shall violate any provision of this Act, or any regulation of the Board of Live Stock Commissioners authorized by this Act, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined not less than one thousand dollars nor more than ten thousand dollars for each offense.

Sec. 14. Any person or persons that shall by himself or themselves, or by his or their servants or employes, move any such prohibited animals on foot, or over any ferry into this State, or shall violate any provision of this Act or any regulation of the Board of Live Stock Commissioners authorized by this Act, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined not less than twenty-five dollars nor more than two hundred dollars

for each offense and shall be committed to the county jail until such fine and costs are paid.

Sec. 15. All fines recovered under the provisions of this Act shall be paid into the county treasurer of the county in which the suit is brought to recover the same, to be used for county purposes, and it shall be the duty of the State's Attorneys in their respective counties to prosecute for all violations of this Act.

Sec. 16. To carry into effect and to enforce the provisions of this Act, the sum of one hundred and fifty thousand dollars ($150,000) annually is hereby appropriated for the years 1909 and 1910, the same to be expended by the Board of Live Stock Commissioners.

Sec. 17. Inasmuch as the health of the dairy and breeding stock of the State is endangered from contagious disease known as tuberculosis among cattle, an emergency exists requiring this Act to take effect immediately; therefore this Act shall take effect and be in force from and after its passage.

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